

Math 130
Fall 04

Study Group Homework: Addition
November 8-9

1. Do Exploration 3.2 on page 54 of the Red Book. This exploration is on mental math. Be sure you give yourselves time to think quietly about each problem before discussing it, and then take time to listen carefully to each other's strategies. Give your favorite strategies names and come to class ready to share them.

2. Below is a base 10 addition table. To some children, this table seems to represent one hundred different "addition facts." Imagine if the table were filled in randomly, and you had to memorize 100 entries – wouldn't be easy.

Part of what makes the task of learning "addition facts" easier is that they are related, as evidenced by patterns in the table.

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

- Find as many patterns as you can in the table. Justify your patterns, if you can.
- Can you translate some of your patterns into properties of addition? For example, the first row and column are the same as the headers, which is equivalent to saying that adding zero doesn't change the sum, or that for any whole number n , we have $n + 0 = 0 + n = n$.

c. Note that in any 2 x 2 "box" in the table above, the sums of the diagonals are equal. For example, both diagonals in the box below are equal to 20:

9	10
10	11

Is this pattern always true in the addition table? If so, give a convincing explanation of why. If not, find a counter-example.

- Does the pattern above generalize to bigger boxes? Why or why not?
- Find a quick shortcut for finding the sum of a 3 x 3 box in the addition table.

3. a. Fill in the base 5 addition table below:

+	0	1	2	3	4
0					
1					
2					
3					
4					

b. Look for patterns. Which of the patterns that you found in the last question work in base 5? Which need to be modified? Which can't be modified?

4. Make addition tables in two other bases of your choice, and compare and contrast the patterns in the four bases you've looked at.

5. Look at problems 2 f, g, h; 3 (Babylonian only), 9, 10 on pages 116-117 of the Green Book. In the Mayan system, can you find any numbers that can be written in more than one way?

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